

MONTHLY WEATHER REVIEW,

JUNE, 1877.

WAR DEPARTMENT,

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DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

The present REVIEW for the month of June depends upon all data received up to the 14th of July from the Canadian Meteorological Service, the United States Signal Service and Voluntary Observers, the Army Post Surgeons and the United States Navy. The most interesting features have been: First, The high temperatures in California; Second, The heavy rains in the Mississippi and Missouri valleys; Third, The numerous severe local storms; and, Fourth, The general diminution of grasshoppers and locusts.

BAROMETRIC PRESSURE.

In General.—The general distribution of barometric pressure for the month is shown by the isobars on chart No. II, from which it will be seen that the highest pressure has been off the South Atlantic coast, whence it diminished very regularly northwestward towards Dakota, in the northern part of which Territory it is probable that the lowest monthly average will be found. The isobar of 29.80, as shown on this chart, agrees very closely in its position with those that obtained in the previous years, 1872 to 1876, inclusive. The pressure has been slightly lower at San Diego, Cal., and lower at Portland, Or., than in previous years.

Barometric Range.—The general range of the barometer over the whole country east of the Rocky Mountains was about 1.15 inch, as may be seen from the following table, which gives the maximum and minimum pressures that occur on the tri-daily maps near the centres of the respective areas of high and low barometer:

LOW AREAS.				HIGH AREAS.			
No.	Location.	Date.	Minimum Pressure.	No.	Location.	Date.	Maximum Pressure.
I	Manitoba	June 1st, 7:35 a. m.	29.35	I	South Atlantic coast.....	June 2nd, 7:35 a. m.	30.27
II	Ohio valley	June 5th, 4:35 p. m.	29.50	II	Cape Breton	June 8th, 7:35 a. m.	30.28
III	Lower Missouri valley.....	June 6th, 11 p. m.	29.23	III	Shreveport, La	June 10th, 7:35 a. m.	30.23
IV	Lake Erie	June 9th, 4:35 p. m.	29.43	IV	Cape Breton	June 12th, 7:35 a. m.	30.33
V	Lake Michigan	June 11th, 7:35 a. m.	29.74	V	Manitoba	June 19th, 7:35 a. m.	30.27
VI	Missouri valley	June 14th, 4:35 p. m.	29.00	V	Lake Superior	June 19th, 4:35 p. m.	
VII	Manitoba	June 17th, 4:35 p. m.	29.45	VI	East Gulf coast.....	June 20th, 7:35 a. m.	30.18
VIII	Cape Breton.....	June 22nd, 4:35 p. m.	29.27	VII	Upper Michigan.....	June 22nd, 7:35 a. m.	30.20
IX	Manitoba.....	June 23rd, 4:35 p. m.	29.35	VII	Middle Atlantic States..	June 23rd, 7:35 a. m.	30.21
X	Kansas	June 25th, 4:35 p. m.	29.50	VIII	Cape Breton	June 30th, 7:35 a. m.	30.21
XI	Lake Superior	June 30th, 11 p. m.	29.29				

The greatest local barometric ranges have been as follows: 0.91 at Bismarck and Escanaba; 0.92 at Breckenridge; 1.10 at Duluth; 1.02 at Marquette; 0.94 at North Platte.

The least local barometric ranges have been: 0.45 at Indianola, Shreveport and Montgomery; 0.43 at Vicksburg; 0.44 at St. Louis and Cairo; 0.88 at St. Marks; 0.36 at New Orleans and Mobile; 0.40 at Galveston and Jacksonville; 0.41 at Memphis.

Areas of High Pressure in General.—The areas of high pressure have as usual during the summer consisted principally of the encroachments upon the Gulf and Atlantic coasts of the general area of high pressure pro-

vailing over the Atlantic. The high pressure areas, due to the flow of cold, dry air southeastward from the Rocky Mountain region and British America, have been but very feebly marked—only two such areas, Nos. V and VII, are included in the following list:

No. I.—Was central over the South Atlantic States during the 1st, and over the East Gulf States during the 2d, 3d and 4th, and over the eastern portion of the Gulf of Mexico on the 5th, by which time the pressure had diminished to 29.90, or less, but rose again on the 7th to 30.05, or more, and so continued over Florida and the South Atlantic coast until the 9th.

No. II.—Pressure rose on the 6th over Nova Scotia, with easterly winds, and continued rising during the 7th and 8th, but fell to 30.00 on the morning of the 10th.

No. III.—Pressure rose on the 9th in Texas, with northwest winds, which winds at that time prevailed over the Ohio region, northward to Manitoba. The area of highest barometer continued in Texas during the 10th, and extended slowly eastward to the Mississippi valley, where it remained during the 11th and 12th, after which it diminished slowly, with southerly winds.

No. IV.—Pressure increased during the 11th on the entire Atlantic coast, and especially with easterly winds in the Middle Atlantic States. North and east winds prevailed on the 12th at most of the coast stations, the isobars continued trending parallel to the Appalachian range, and pressure at 11 p. m., of the 12th, ranged between 30.20 in South Carolina and 30.30 at Cape Breton. The barometer fell during the 13th, but remained highest near Cape Hatteras during the 14th and 15th, after which it remained highest off the South Atlantic coast and over Florida until the 17th and 18th.

No. V.—In the rear of low barometer No. VII, pressure rose rapidly in Manitoba, where it was 29.74 at 7:35 a. m., of the 18th, but 30.27 at 7:35 a. m., of the 19th. This area of high pressure moved rapidly southeastward, and was central in the St. Lawrence valley at 7:35 a. m., of the 20th, and off the Middle Atlantic coast at 4:35 p. m.; it was immediately followed by low barometer No. VIII.

No. VI and VII.—Pressure was high at stations on the Gulf coast from 19th to 31st. On the 21st, immediately in the rear of low No. VIII, it rose rapidly over the Upper Lake region; on the 22nd, at 7:35 a. m., it was highest over Lake Superior; on the 23rd, 7:35 a. m., over Pennsylvania; on the 24th, 7:35 a. m., off Cape Hatteras. The pressure was high over the Southern States on the 25th, and over the eastern portion of the Gulf States, on the 26th, 7:35 a. m.; over the lower Missouri valley on 27th, 7:35 a. m., after which it diminished.

No. VIII.—Pressure rose on Middle and East Atlantic coast on the 28th, while, in the interior of the country, low barometer No. XI was developing; easterly winds prevailed at most of the Atlantic coast stations, and the highest pressure, which was at first central off the Middle and East Atlantic coast, was by 7:35 a. m., 30th, transferred to the South Atlantic coast, while the isobars continued trending parallel to the mountain ranges.

Areas of Low Pressure in General.—Eleven areas of low pressure are enumerated in the following list, of which nine were sufficiently definite to justify the charting of their tracks, as given on map No. I. In general, their paths lay considerably to the north of those charted in June, 1875 and 1876 and agree better with those charted in June 1873 and 1874. The areas of low pressure that have passed from the Rocky Mountains eastward, during the month of June, appear, in all cases, to have originated on the eastern slope. The principal depression that occurred on the Pacific slope was 29.75 inches on the 12th at San Francisco, which was accompanied by, and may have been due to, an extensive depression in Nevada, Colorado, Dakota and other portions of the Rocky Mountain region.

No. I.—This depression appears on the morning of the 1st central in Minnesota, and appears as a trough stretching north and south, lying between areas of cold northwest winds on the west and warm southerly winds on the east. It moved to the north-northeast until beyond our stations and then passed, during the 2nd and 3rd, eastward over Canada; it disappeared on the 4th over the Gulf of St. Lawrence. During these three days the prevailing low pressure in Canada and high pressure in the Southern States gave rise to steady south and west winds and numerous areas of local rains over the Lake region, the Middle and Eastern States.

No. II.—During the 3rd increasing southeast winds prevailed from Texas to Missouri, culminating during the night in local rain-storms in Indian Territory. On the morning of the 4th, the pressure was lowest in the Missouri valley, whither the winds tended during the rest of the day. The 4:35 p. m. map of the 4th shows rain-fall at nearly all stations between Minnesota and Indian Territory. Concerning the severer local storms occurring on that day at Mt. Carmel, Mattoon, Boonville, &c., see the appropriate chapter. The fall of the barometer appears to have been most decided on the eastern side of the low area, which accordingly moved due eastward between the regions of cold northerly and warm southerly winds that lay north and south of its track. Its centre was on the morning of the 5th in eastern Illinois, and on the

morning of the 6th in West Virginia, whence it stretched very slowly eastward until it disappeared, on the morning of the 7th, off the coast of New Jersey.

No. III.—This depression originated on the morning of the 5th in Dakota and Manitoba, on the western edge of the extensive area of cool air that pressed southeastward in the rear of low barometer No. II. During the afternoon of the 5th, the barometric depression extended rapidly southward into Kansas, its centre remaining apparently in Dakota or possibly still further to the northward, but on the morning of the 6th it is judged to have been located in Nebraska, because in that region the opposing northwest and southeast winds were then prevailing. The southern end of the trough was, as is usual, rapidly closed up by the cold, northwest winds, which attained a velocity of 56 miles per hour at Dodge City, Kansas, at 4:35 p. m. of the 6th, and at 11 p. m. a very considerable and well-marked depression was central in Iowa, with brisk and high northwest winds in the Missouri valley. The depression now passed northeastward to Lake Superior, where it was central at 11 p. m. of the 7th, after which it disappeared. The heaviest rain-falls attending the progress of this low area were in the immediate Missouri valley, and occurred during the prevalence of cold northwest winds, or just preceding the shifting of the winds to that quarter, and generally in rear of the principal area of low pressure.

No. IV.—Between the 6th, 11 p. m., and the 7th, 11 p. m., the temperature fell 9° at Cheyenne, 15° at Denver, 9° at Santa Fe, 7° at Leavenworth, 6° at Shreveport, and similarly over the entire intermediate region, near the centre of which the opposing northwest and southeast winds continued to meet during the entire twenty-four hours. In this region originated storm No. IV, whose centre is placed in the northeastern corner of Indian Territory, at 11 p. m. of the 7th, at which time therefore it appears as the southernmost of a series of depressions, of which No. III is also one. On the 8th, at 4:35 p. m., No. IV was central in northern Illinois; at 11 p. m. in southwestern Michigan, and on the 9th, at 7:35 a. m., over Lake Huron. Heavy rains had accompanied its progress throughout the Gulf States, the Ohio valley, Missouri and Illinois. At Memphis nine inches had fallen up to 4:35 p. m. of the 8th, and four and a half inches more fell on the 9th before 7:35 a. m. Under these circumstances a decided fall of the barometer took place over Tennessee and Kentucky, and there is reason to assume that a small secondary depression moved northeastward nearly parallel with the principal one, and was, during the night of the 9th, united therewith in the northern portion of Canada. During the afternoon and evening of the 9th, these depressions being then in the Lower Lake region, there were experienced on Lakes Erie and Ontario heavy southwest winds, with rain. On the 10th this depression moved northeastward down the St. Lawrence valley, and disappeared over the Gulf.

No. V.—During the morning of the 10th the pressure rose at most stations east of the Rocky Mountains; but by 4:35 p. m. a slight depression had become manifest in Illinois and eastern Iowa, extending thence southwestward to northern Texas. This slight depression moved slowly northeastward and disappeared by midnight of the 11th over Lake Superior. It was not marked by the prevalence of any extensive area of high winds or of heavy rains.

No. VI.—The pressure continued low from the Upper Lake region westward to the Rocky Mountains during the 12th and 13th, and was also quite low in California. It fell slowly in Texas and at most of the Rocky Mountain stations. It was high, but falling, during the 12th in Oregon; where, on the 13th, at 4:35 p. m., it was 29.96, after which it rose somewhat. It appears, therefore, that a very general depression existed during these days over a greater part of the region lying between the Missouri, the Mississippi and the Pacific, and that it originated in this region seems the most plausible assumption. On the 14th, at 4:35 p. m., we have the first reports of northerly winds in Dakota and Wyoming, and may place the centre of greatest barometric depression in northern Nebraska. A rapid rise in pressure now occurred to the northward, with colder northerly winds, and the depression stretched, as usual, northeast and southwestward into a trough which, on the 15th, at 4:35 p. m., extended from Missouri northeastward over Lake Huron and beyond; its centre is at this time placed at Mackinac. At 11 p. m. this trough evidently extended from Missouri to the mouth of the St. Lawrence, being, as usual, the boundary between the areas of northerly and southerly winds. During the 16th this depression broke up into several ill-defined areas, of which the principal one was over the Gulf of St. Lawrence, where the pressure continued low during the 17th.

No. VII.—This depression appears first on the afternoon of the 16th in western Dakota, and was, apparently, at that time the southern end of a trough trending still further northwestward. At 4:35 p. m., the temperature had risen remarkably in Indian Territory, Kansas, Nebraska, Colorado and Utah. At 11 p. m., high temperatures prevailed in Minnesota, Iowa and Nebraska, and the winds were uniformly directed towards western Dakota. On the 17th, at 7:35 a. m., high temperatures prevailed from Kansas northward to Manitoba. The pressure had very generally fallen; southeast rather than southerly winds prevailed, and several local rains or hail-storms were reported. The southern end of the barometric trough, that was evidently still forming, was probably at this time in Manitoba, but at 4:35 p. m. of the 17th, it can be located, with certainty, in northeastern Dakota; it was, at 11 p. m., in northern Minnesota; on the 18th, at 7:35

a. m., the trough stretched from eastern Nebraska to Lake Superior, but at 4:35 p. m. the pressure had rapidly filled up on its western sides, where an area of high barometer then appeared, and the low pressure, like its predecessor, stretched as a series of slight depressions from Kansas to Lake Huron. At 11 p. m. of the 18th, the isobar of 29.90 extended from Indian Territory to the Gulf of St. Lawrence, very much as was the case at 11 p. m. of the 15th, and the only low pressures were in northern Canada, beyond the limit of our stations, where, however, they apparently continued to progress eastward, giving rise to the low pressure that prevailed over Newfoundland on the 19th.

No. VIII.—The barometer was low on the 19th over California, Oregon and Rocky Mountain stations, while high pressure No. VII was over the Lake region. Low pressure No. VIII appears to have been central in western Dakota at 11 p. m. on the night of the 19th; commenced to move slowly to the ENE. on the 20th, and, at 11 p. m., was central north of Lake Huron. The northerly winds that followed it were accompanied by extensive heavy rains, which, on the same date, prevailed over lower Michigan, Wisconsin, Illinois, Iowa and the lower Missouri valley. This region of heavy rains lay in the rear of and on the SW. side of the region of lowest pressure, but on the northern limit of the region of fresh southerly winds. The succeeding weather map, June 21st, 7:35 a. m., shows that this area of rains had moved eastward to the Lower Lake region, while the area of low pressure had extended rapidly southward, and during the rest of the day covered the Middle and East Atlantic States. The 7:35 a. m. report of the 22nd shows that heavy rains had fallen over the Middle Atlantic States wherever the cooler NW. winds had replaced the warm southerly winds of the preceding morning, and therefore under circumstances precisely similar to those that accompanied the heavy rain of 11 p. m. of the 20th in Iowa, Wisconsin, &c. After 11 p. m. of the 21st the pressure fell rapidly over Maine and the Canadian Provinces, and the area of lowest pressure disappeared over the Gulf of St. Lawrence on the 22nd.

No. IX and X.—This extensive but indefinite area of low pressure No. IX was developed on the 22d, over the Rocky Mountain region, and on the 23rd extended southward from Manitoba into the Missouri valley. During the 23rd, 24th and 25th, the central lowest pressure probably moved eastward through Northern Canada, while there was visible within the region covered by our western stations only the southern extremity of the extensive trough of low pressure; near the southern extremity of this trough there originated on the 24th, a series of severe local storms, which are fully described on p. 7. During the 26th, the area of falling barometer extended eastward into the Middle States, and the numerous local rains and storms that prevailed over the Ohio valley, the Northwest and Lake region, were followed by a decided rise in pressure and cooler northwest winds. At 11 p. m., on the 26th, the lowest pressure was over Penn., and at 7:35 a. m. on the 27th, it was off the Middle Atlantic coast. At this time pressure was nearly uniformly lowest, although not very low, from the Middle Atlantic coast westward to Kansas, and during the rest of the day, a slight depression developed over the Middle Atlantic States, while the pressure rose both northeast and northwestward. On the 28th, at 4:35 and 11 p. m., a slight depression existed off the South Atlantic coast, which is numbered X in our list. The tracks of Nos. IX and X are too indefinite to admit of being charted.

No. XI.—The pressure was low in Oregon at 4:35 and 11 p. m. of the 27th, which depression was apparently but a part of that which then prevailed over most of the Rocky Mountain stations. The central lowest pressure was probably at 11 p. m. either in Wyoming or Montana, whence it moved eastward over Dakota and Minnesota and Lake Superior, as a well-marked area, preceded by very warm southerly winds and followed by high northwest winds. At 11 p. m. of the 30th it was probably central over the northeastern portion of Lake Superior. The further history of this storm-centre belongs to July, as it disappeared on the 3rd over the Gulf of St. Lawrence.

Vessels Experiencing Storms at Sea.—1st, N. 49° 29', W. 6° 0', strong WSW. gale and heavy swell. 2d, N. 48° 47', W. 28° 7', strong NW. gale and high sea; N. 49° 27', W. 9° 12', strong SW. gale and heavy rain. 9th, N. 43° 37', W. 47° 12', strong N. and NNW. gale. 12th, east coast of Mexico, severe norther.

TEMPERATURE OF THE AIR.

In General.—The general distribution of temperature for the month is shown by the isotherms on chart No. II. A comparison with the averages for June during the past 7 years shows that the temperatures have been slightly above the average in New England and the South Atlantic States, but slightly below in the St. Lawrence valley, Upper Lake region, Ohio valley and Tennessee and the Lower Missouri valley, and decidedly below in the Upper Mississippi and Missouri valleys and in Minnesota.

Monthly Mean Temperatures, at special points, have been as follows: Mt. Washington, 44°.8; Pike's Peak, 28°.1; Virginia City, 52°.8

Maximum and Minimum Temperatures.—Maximum temperatures above 95° were reported as follows: 96°, Corsicana, Nashville, Shreveport, Washington; 97°, Denison, Augusta, Tybee Island, Wilmington;